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Thermodynamics and Structural Transition of Binary Fermi-Bose Mixtures of Ultracold Atoms TOM KIM, CHIH-CHUN CHIEN, Univ of California - Merced — A mixture of spin-polarized fermionic and repulsive bosonic ultracold atoms can go through phase separation if the boson-fermion interaction is sufficiently large. By evaluating the grand partition function using techniques from quantum field theory, we obtain the thermodynamic free energies and its associated quantities in a broad range of temperatures and interaction strength. Stability of a mixture can be inferred from the free energy as the parameters are changed. For a uniform box potential, strong interspecies repulsion separates the bosonic rich and fermionic rich regions, and the thermodynamic quantities of each component can be systematically determined. We map out the full phase diagram of mixtures in a uniform box potential. In the presence of harmonic trap, the density is not uniform. By using the local density approximation, we found several different structures, such as partially mixed regions or fully separated regions, depending on the densities and interactions. We consider realistic parameters from ^{6}Li and ^{7}Li mixtures and ^{6}Li and ^{41}K mixtures.

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